

and the information supplied by the collector regarding them may be meagre. But Dr. Cooke, with his ripe experience in India, is in a position of vantage. His descriptions of genera and species are clear and vivid, and at times include information on vegetative characters that can be observed only on the spot. It may be suggested, however, that an even more free record of vegetative characters would greatly facilitate the identification of a plant by a person happening to meet with it in blossom but not in fruit, and would supply botanists at a distance with valuable information otherwise inaccessible. To take specific examples. The two indigenous lythraceous genera with indefinite stamens, *Lagerstroemia* and *Sonneratia*, are distinguished from one another in the analytical key by their fruits; yet their habits and habitats are sufficiently dissimilar to be of immediate use in an analytical key, but we are not told in the present work whether or no *Sonneratia apetala* possesses the erect respiratory roots so characteristic of *S. acida*. Again, in the Rhizophoraceæ, the four genera of the saline swamps and littoral situations are at once separable from the inland *Carallia* by their habitats, apart from the seeds, which are used as the basis of distinction in the analytical key. Furthermore, species of *Rhizophora* emit aerial roots from their epigeous branches, and thus stand apart from other rhizophoraceous plants, and, indeed, so far as I know, from all mangrove plants except *Acanthus ilicifolius*. Surely the mention of these roots would greatly facilitate recognition of species of *Rhizophora*, yet no mention is made of them; and if, as is quite conceivable, these species are apt not to possess them in Bombay Presidency, information to this effect would be of extreme interest to botanists. Whilst discussing vegetative characters, it may be remarked that the "white spongy bodies" in the shoots of *Jussiaea repens* are adventitious roots, not stipules. And the generally accepted view in regard to the leaves of *Rubia* is that they are stipulate, but that the stipules are often leaf-like in form.

Dr. Cooke's analytical keys of genera and species are, it need hardly be stated, admirable examples of the approved form, and he may be wise in adhering to the system that experience has shown to be most useful, even though it frequently assumes that a person using the "flora" possesses shoots, flowers and fruits of the specimen he desires to identify.

The attractive and clear detailed descriptions of the species are succeeded in most cases by mention of the times of flowering. In many instances there is no record as to whether a plant described is deciduous or evergreen. Records on this point, coupled with additional information as to the times of opening of floral and vegetative buds, and of the shedding of the leaves, would throw much light upon the scarcely touched subject of the periodicity of plant-life in the tropics. As this subject has, in addition, considerable practical economic significance, it is to be hoped that authors of the Indian "regional floras" will record such of these data as are known, and will thereby stimulate further observation.

On the question of geographical distribution, facts

are given as to the occurrence of the indigenous species in places outside the Presidency, and many details are added concerning their frequency of occurrence, localities and habitats, within the Presidency. But the author specially directs attention to the need for information on the local distribution of species. Despite of this lack of complete information, the hope may be expressed that Dr. Cooke will include in his work some account of the floristic subdivisions of the Presidency dealt with, and that the authors of other Indian "regional floras" will do likewise. Of equal scientific interest, and probably of greater practical importance, would be an account of the distribution of types of vegetation, or plant-formations, within the area. Such an account of the distribution of types of vegetation within Bombay Presidency would be of especial botanical interest, for

"the rainfall varies . . . from 3 or 4 inches, or even less in the almost rainless districts of Sind, to upwards of 300 inches on the Western Ghâts."

The vegetation shows corresponding diversity, varying from arid or rocky desert-tracts to moisture-laden evergreen forests. As to the practical aspect, we now recognise that vegetation reflects in its form the environment, and that plants, when their actions are interpreted aright, are more cunning analysts of external conditions, including soil and climate, than are the most accomplished chemists and meteorologists.

Brief references to the economic uses of many of the species described, and vernacular names, add value to the book before us.

In conclusion, Dr. Cooke is to be congratulated on producing a most excellent work.

PERCY GROOM.

#### THE STUDY OF FERMENTATION.

*Fermentation Organisms, a Laboratory Handbook.* By Alb. Klocker. Translated from the German by G. E. Allan, B.Sc., and J. H. Millar, F.I.C. Pp. xx+392. (London: Longmans and Co., 1903.) Price 12s. net.

THE importance of a systematic study of the micro-organisms which play a part in the various processes of fermentation is making itself felt more and more as time goes on and new facts and phenomena are brought to light. The old empirical methods of twenty years ago have passed away before the marvellous changes first introduced by Hansen, and the culture of yeast is recognised as one of the secrets of success in the manufacture of the various kinds of beer. The study has long been carried on under the personal supervision of Hansen and his assistants, but until recently has been almost entirely conducted under some form of personal supervision. As in other cases, however, the study has outgrown so limited a method of teaching, and we have in this volume a laboratory handbook which will enable practical work in the culture of fermentation organisms to be more widely spread, and probably more successfully conducted, than has hitherto been the case. The volume is welcome on this account especially, but it has other claims also on the student, coming as it does from the

Carlsberg laboratory, and embodying the ideas and teaching of Hansen himself. It is welcome also to English readers from the fact that it has been translated in great part by one of the disciples of the Burton-on-Trent school, from which have come so many valuable contributions to our knowledge of the chemistry of the carbohydrates concerned in brewing.

The author has described at great length what we may consider to be an ideal laboratory for the practical study of the lower fungi, including, indeed, the pathological bacteria, though these are not necessarily included in the range of study he sets forth. His description is greatly to be commended, for he is not satisfied with saying what apparatus should be provided and what precautions observed in arranging the laboratory, but he gives a careful explanation of the reasons underlying his plans, so that mere empirical work has no place in this course. The descriptions of apparatus are good, showing what are the best forms of the modern appliances now at the disposal of workers at the subject. Perhaps a little less detail would have sufficed in the section upon the microscope, as the instrument has now so widespread an application in so many branches of science. Workers will welcome especially the instructions given in the methods of culture of micro-organisms, from the original methods of water culture of Hansen to the modern plate cultures, in which gelatin and similar media take so large a part.

A very important section of the work is devoted to the biological analysis of yeasts, and the methods of ensuring pure cultures. Also to the biological analysis of water, air, and soil.

In the later portion of the volume the author treats in some detail of the fermentation organisms themselves. In this section the *Saccharomycetes* occupy the largest place, as is natural when we consider the fermentations in which they play a part. *Mucor* and its allies, however, are not neglected, and fair attention is given to the ascomycetous moulds. Their diagnostic features are described, and the part they play in various fermentations is discussed, the idea being kept prominently in view that the author is writing as a teacher for students, and that the work is a laboratory handbook. Finally, the bacteria come in for recognition.

The book will be welcomed further for the very admirable historical sketch of the gradual development of our knowledge of fermentation from the earliest times. It is very satisfactory to find that this section contains an admirable summary of the work of Hansen himself.

The volume concludes with a very complete bibliography.

#### OUR BOOK SHELF.

*Five Figure Logarithmic and other Tables.* By Alex. M'Aulay, M.A. Pp. xl + 161. (London: Macmillan and Co., Ltd., 1903.) Price 2s. 6d.

*Siebenstellige Logarithmen und Antilogarithmen.* By O. Dietrichkeit. Pp. 64. (Berlin: Julius Springer, 1903.) Price 3 marks.

THE book by Mr. M'Aulay is of a very handy size, specially adapted for the pocket. The author, in the preliminary pages, explains the general properties of

logarithms and the use of the tables which follow. The tables themselves comprise, first, an ordinary four-figure table of logarithms of numbers, occupying two pages, and without the usual antilogarithms. Next, a five-figure table of logarithms of numbers from 0 to 100,000, with a complete set of proportional parts or differences; these take up thirty-six pages. Then comes the second principal table of the book, giving the logarithmic sines, cosines, tangents, and cotangents of angles for each minute, with differences for intervals of ten seconds. Some subsidiary tables and useful numbers follow, very much condensed, so as not materially to add to the size of the book.

The tables would be improved if they could be provided with a marginal or thumb index to facilitate reference. The two main tables are printed in clear bold type, and the little volume will prove extremely useful to all who require greater accuracy than is given by four-figure mathematical tables.

The tables of Herr O. Dietrichkeit are most ingeniously arranged. The numbers in the columns are given to seven figures, the last two of which are written as suffixes in smaller type. The logarithm or anti-logarithm of any four-figure number can be read directly from the tables to any desired accuracy up to seven figures without requiring differences to be used. The two tables of logs and anti-logs are printed on paper of different tints, a very good feature, and they occupy only eighteen and twenty pages respectively. They are provided with a complete thumb index, reading both backwards and forwards, and it will be found that readings may be taken from the tables almost, if not quite, as quickly as from the well-known four-figure tables.

If five-figure accuracy were required for five-figure numbers, the difference for the fifth figure would have to be calculated. And it is possible from these tables, although occupying only a few pages, to obtain seven-figure accuracy for seven-figure numbers, by means of an interpolation constant and a most ingenious method of calculation, which, however, would be too long except for occasional use. The tables will prove most valuable in cases where, though four-figure accuracy is usually sufficient, it is desired to have at command a means of greater accuracy for special purposes. The volume is beautifully got up and printed, and it is quite a pleasure to use the tables.

*Économie rurale.* By E. Jouzier (*Encyclopedie agricole*). Pp. xv + 476. (Paris: Baillière et Fils, 1903.) Price 5 francs.

THIS book belongs to a type of which we have few representatives in this country; it consists of a discussion of such general principles of political economy as may be illustrated in the conduct of a farm.

Beginning with an account of the relations of agriculture to the State, questions of taxation, transport and markets, it proceeds to discuss the capital required in the business of agriculture, the live and dead stock, insurance, depreciation, and the valuation of such contingencies as cultivations and manurial residues. Such general principles as the minimum of production necessary to profit and the law of diminishing returns are explained and illustrated. Questions of labour, methods of finding the cost and profit or loss of the different operations are considered; finally, tenure, compensation for improvements, systems of land holding, cooperation, and similar matters touching on the economics of agricultural production are dealt with. The whole is treated in a somewhat abstract and generalised fashion, and would find little favour with the practical farmer or landowner here; we can, however, commend the book to teachers of agriculture as suggestive and likely to lead to a wider outlook than generally prevails in the treatment of similar questions in this country.